

Design and Implementation of an Automated Advert Management System for Small and Medium-Scale Enterprise

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Abstract

This study on Design and Implementation of an Automated Advert Management System for Small and medium scale Enterprise is done to help businesses in this bracket manage and schedule their online advertisements using digital technologies. Most of these entrepreneur's experience difficulties posting their advertisement at the right time due to busy schedules, distractions and limited technical knowledge. This, in no small measure, won't allow for wider customer reach leading to low customer engagements. Based on these challenges, a platform which is user friendly, reliable, efficient and secured that can upload and store digital advert contents was created. This is carried out using the Prototype Model of the System Development Life Cycle (SDLC). Python (Django) for backend logic, React.js for the user interface, Firebase for cloud storage, and MySQL/PostgreSQL for database management. At the end, an automated advert management system is produced which will eliminate manual effort, improves advert timing, and to some point help entrepreneurship maintain consistent online presence.

Keywords: *Automated Advert Management System, Design, Implementation, Small and Medium-Scale Enterprise*

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Background to the Study

Digital advertising is a central channel that exhibit the attribute of reaching and engaging customers by small and medium-scale enterprises. This has been in practice but yet, many SME struggle to maintain regular online advertising activities plus taking care of the daily demands of their businesses. Observations through real-life scenarios in the course of this study indicates that some tasks like inventory control, customer interacts and daily administration mostly depends on priority and little time devoted for structured advertising preparation. In lieu of this, advertising posting is delayed, irregular and omitted. This, in no small measure, won't allow for wider customer reach leading to low customer engagements. Actually, there have been different social media management tools in existence. These tools are to address the attendant challenges but unfortunately, there are still limitations in dealing with the efficiency and effectiveness for SME. It is worth noting that some of these tools are made up of sophisticated features like advanced analytics, multi-layer automation and well-detailed configuration settings. The evidence gathered in the course of this study indicate that such tools are cumbersome for SME owners who needs easier to use, affordable and quick operational value than complex systems requiring significant technical familiarity.

In lieu of this constraint, this study develops an automated advert management system only for the SME users. The system when applied has made advertising work to be simpler and easier by enabling users to upload their contents and schedule their posts across two platforms thereby avoiding repeating manual input. The design process uses continuous feedback from SME users so that features like flexible scheduling and efficient media handling condoned with the actual operational requirements. The structural view of the system is functional and scalable. The backend is done using python with Django framework, on the basis of having strong security features and perfect in handling task scheduling support, React.js is for the frontend based on it allow responsive and friendly interaction. For the securing of media files firebase is used, while relational data which are necessary to schedules information and user profiles, MySQL/PostgreSQL is used. Social media platform which is used to publicize information, particularly Facebook and Instagram were selected.

The benefits of this study can be left out. Firstly, when applied and used to the fullest, it gives a functional and scalable platforms thereby supporting the development of practicable platforms that can help small and medium scale business owners manage their advertising activities effectively. Secondly, the features such as usability and relevance showcase the usefulness of using user-centered feedback into the system design process. Then thirdly, it brought in an architecture that is flexible and extensible which in turn support future enhancements such as additional platforms and analytical capabilities. The everyday realities of the operations of the SME in line with system functionality, proves that the study has done a commendable contribution in the areas of improvement of digital advertising efficiency in the small business sector.

Related Works

It is worth noting that studies on automated advertising system has presented efficiency as the key benefit when it comes to maintaining regular posting. Past studies emphasizes the role of

scheduling mechanism in maintaining regular posting thereby bringing manual workload to a minimal level (Olujimi & Ade-Ibijola, 2022). Though, these reports are mostly shown through engagement indicators with little attention given when it comes to how the system is actually used by small business owners. In lieu of these, you will concur with me that it will not be so easy to relate the system design and daily operational constraints.

Facts gathered from SME- focused have a meaningful counterpoint. Instead of focusing on the capability of the system, this study emphasizes the right time digital tools are fit to be adopted or ignored. Some constraints such as time scarcity, limited in finance and most importantly interface complexity are most often identified interfaces (Kedi et al., 2024; Nor et al., 2025). As it stands now, attention is not always based on the interaction of these constraints. Practically, situations where there is reinforcement of limited time and complex interface, it is certain that there will be underutilized of system even when they are potentially useful. The observation from this study is in-line with this approach, looking at the efforts and role played in order to continue the system use.

Following the design, the solutions provided by automated advertising is heavier when there is choices especially on infrastructure plus web technologies, cloud storage and third-party integrations (More, 2023). It is note-worthy at this juncture that these approaches mixed together is not regularly documented when deployed in real scenario despite, individually they are well explained. When in operation, irregularities in external service responses are regarded most often as secondary technical although they have direct impacts on user trust thereby establishing differences between the way the system model is and the conditions on which they are meant to function.

However, some approaches brought in from software engineering research says otherwise as regards to treating this gap. Some model especially prototyping has been proved to be better when it involves the system features and what the user expects (Abidemi, 2024). Despite all these, on the abode of advertising tools for SMEs, there is always shortage of facts to prove how user feedback is transformed into stable system adjustments. Most times, users being involved are well spelled-out and systematically, they are not fixed into the development process. In these modern times, discussions are wholly on the structural limitations in the previous tools, most times it is on adaptability. However, some systems especially those that uses a narrow set of platforms have been found to stop their usefulness in dynamic business settings (Gabelaia, 2024). There has been a case which seems similar in this study, when a user chooses solutions that it in the existing practices instead of requesting for its behavioral change.

All these together in this review, indicates the benefits of automation in improving digital advertising efficiency, but it points to a disconnection between the SME usages realities and capability of the system. Previous studies hold performance metrics and technical architecture in view with no integration to these perspectives. This study holds onto this fact by combining user-centered with practical system design in order to design an automated advert management solution that utilizes usability, adaptability and alignment with daily business operations.

Methodology

A Prototype Model of the System Development Life Cycle (SDLC) was adopted. This prototype approach that allows iterative platform development was selected based on the fact that developers are allowed to quickly design a working version of the system, that is refined regularly based on the user feedback.

Prototype Model (SDLC) development stages

1. Requirement Gathering

This first stage is more of identifying the main requirements of the system. Many users struggle with posting adverts on time plus managing digital content manually, when their needs were studied. Based on the analysis, it was gathered that there is need for features such as secure user authentication, management tools for content, Advertisement scheduling, automatic posting mechanisms and proper access control.

2. Preliminary System Design

Following the requirement that have been identified, an initial design of the system was developed. This design will be included: user interface layout, Simple flow of how users will upload, schedule, and deliver advertisement material and preliminary database structure which is necessary for advertisement management and scheduling functionalities. The final process is not the design rather, it is showing of how the system would work.

3. The Construction of the Prototype

A functional prototype of the system was then developed to demonstrate the main features. The prototype includes a login module, authentication, Content upload feature, scheduling functionality, and a basic dashboard for user. Creating a functional but simple version of the system to demonstrate its main features is the main objective.

4. User Testing and Evaluation

The prototype was then tested by users to see how it worked by interacting with the system in order to provide feedback on: Ease of use, Speed of operations, Missing features, errors and difficulties. Improvement can only occur based on users' responses in identify the areas and weaknesses of the system.

5. System refinement and improvement

Based on the feedback received, the system was improved. These warrants correcting and enhancing to be made on the system, like, improving the user interface, fixing errors found during testing, enhancing security features, and Optimizing performance. Testing and improvement need to be repeated until the system met user expectations.

6. Final Implementation

After several refinements, the final version of the system was developed. All major features were completed, including: Secure login system, Content storage and management, Advert scheduling and delivery, Role-based access control. This is the preparation of the system to be use fully.

7. Testing and Deployment

Finally, the completed system was thoroughly tested to ensure, all functions work correctly, data is stored and retrieved properly, unauthorized users are blocked, the system performed efficiently. Once testing was successful, the system was ready for deployment and real-world system is presented through several diagrams that describe its functionality and structure.

The architecture of the system will adopt a three-tier architecture

- i. Presentation Layer (ReactJS)
- ii. Application Layer (Django)
- iii. Database Layer/dashboard (MySQL)

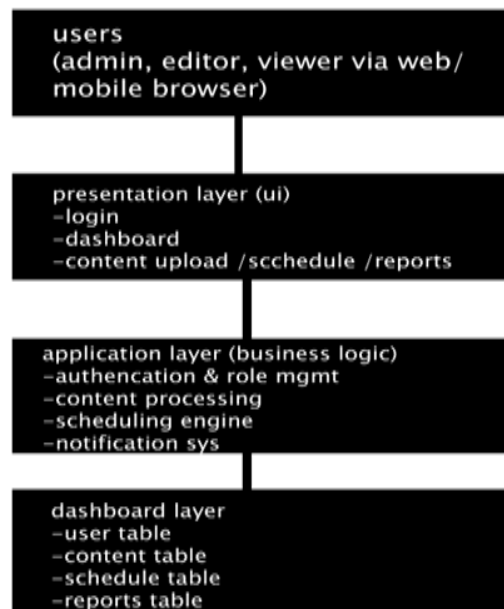


Fig. 1: Architecture Diagram

The figure 1.1 above describe the three-tier architecture of the system. As shown in figure 1: The presentation layer which is the frontend is developed using React.js. It is a user interface designed for administrators, content managers and users. The application layer in the figure 1 is the backend, developed with Django and designed to handle permissions, content management and business logic handling scheduling. Then, the database /dashboard layer is implemented using MySQL/PostgreSQL which is for centralized repository for all content, logs and user details.

System Flowchart

This is a flowchart which showcase all the processes used in the system, such as user login, content upload, scheduling, delivery, and access.

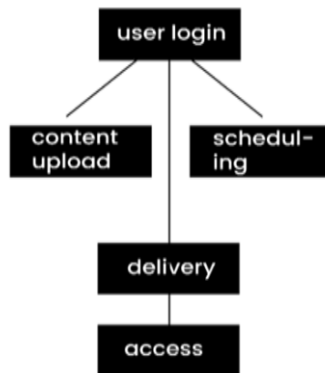


Fig. 2: Flowchart Diagram

Data Flow Diagram (DFD)

Level 0 (Context Diagram): This shows the interaction between the user, administrator, and the system.

Level 1: This breaks down the content upload, management, and delivery processes into detailed flows.

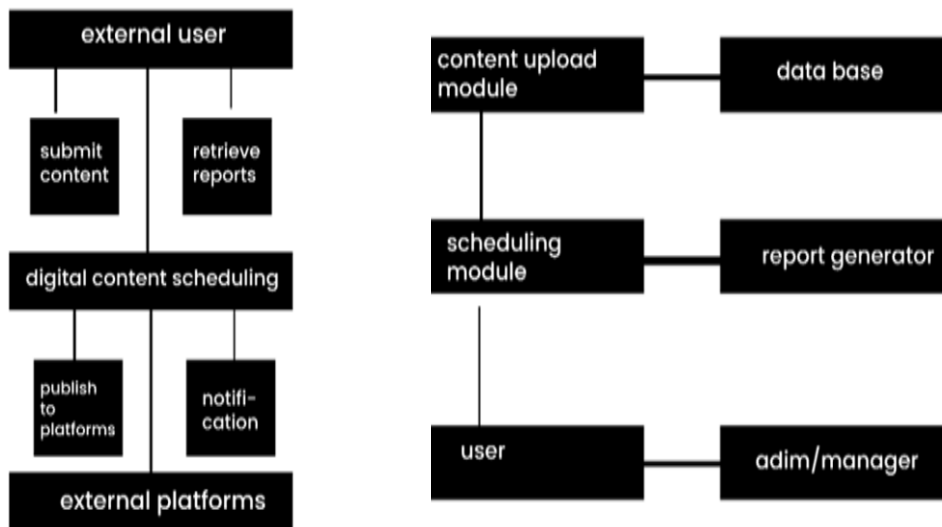


Fig. 3 & Fig. 4: DFD diagrams – Level 0 & Level 1

Entity-Relationship Diagram (ERD)

This diagram is used to model the structure of the database, showing Users, Content, Schedules, Delivery Logs, and their relationships.

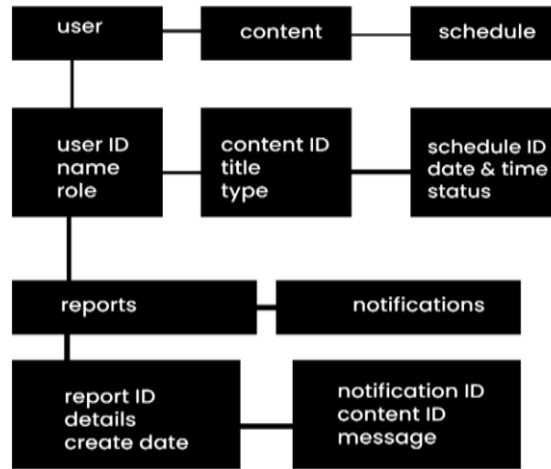


Fig. 5: ERD Diagram

Use-Case Diagram

The use-case diagram highlights the interactions between actors (Administrators, Content Managers, Users) and the system functionalities.

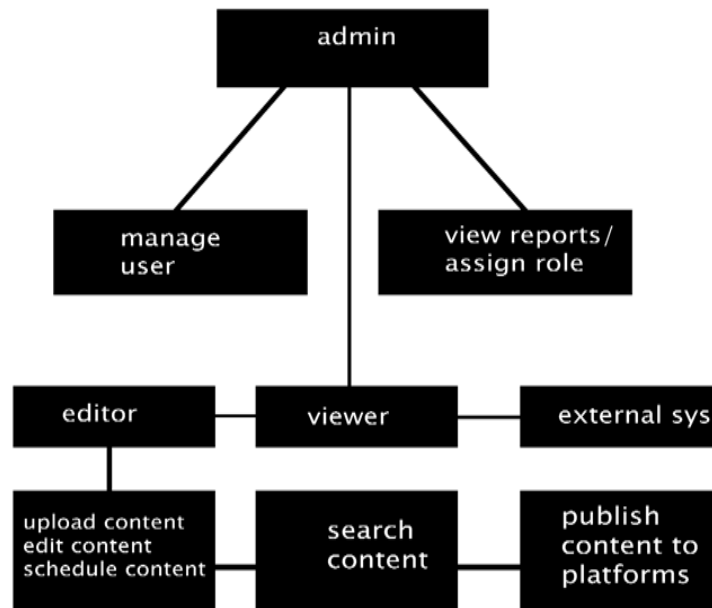


Fig. 6: Use-Case Diagram

High-Level Diagram

The high-level diagram provides an overview of the system modules and their interaction, including Authentication, Content Management, Scheduling Engine, Delivery Module, and Analytics Dashboard

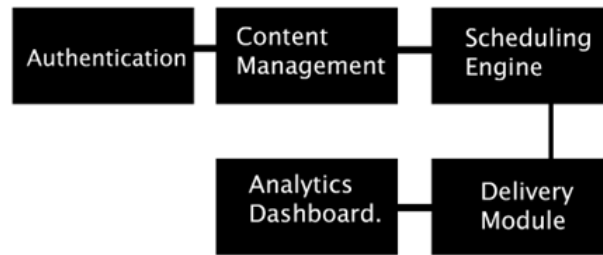


Fig 7: High-Level Diagram

Test Plan

It focused on the following:

- i. Login Test: To ensure users can log in with correct credentials.
- ii. Content Upload Test: To confirm different types of files (video, documents, and images) can be uploaded.
- iii. Content Retrieval Test: To verify stored files can be accessed quickly.
- iv. Database Test: To check if records are saved and retrieved correctly.
- v. Security Test: To confirm unauthorized users cannot gain access.

Findings

The architectural choice with a database and query to develop automated advert management system that will reduce manual effort, improve advert timing, and help business owners maintain a consistent online presence.

Conclusion

From the implementation and testing, it can be concluded that the developed platform achieved its intended goals. It improved the speed, security, and accessibility of digital content when compared with manual or semi-automated systems. The system offers a practical solution to organizations and individuals that rely on timely and secure content distribution.

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